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SYSTEMATICS OF AEDES MOSQUITO PROJECT

ANNUAL REPORT

Wayne N. Mathis

March 12, 1987

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<p>The Systematics of <u>Aedes</u> Mosquito Project (SAMP), a cooperative venture between the Smithsonian Institution and the U.S. Army Medical Research and Development Command, conducts biosystematic research on mosquitoes of medical importance to the Army. SAMP fulfills these objectives by performing biosystematic studies on important groups of aedine vectors of arboviruses. SAMP provides information on potential vectors for the guidance of military field research teams and other governmental agencies and prepares monographs and technical papers, which summarize data on the ecology, taxonomy and medical importance of these vectors in Africa. In addition, SAMP performs curation and research on the national collection of mosquitoes at the National Museum of Natural History (NMNH), Smithsonian Institution.</p> <p>Research continues on the arbovirus vector groups of the subgenus <u>Stegomyia</u>, genus <u>Aedes</u>, of the Afrotropical Region.</p>					
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SUMMARY

The Systematics of Aedes Mosquito Project (SAMP), a cooperative venture between the Smithsonian Institution and the U.S. Army Medical Research and Development Command, conducts biosystematic research on mosquitoes of medical importance to the Army. SAMP fulfills these objectives by performing biosystematic studies on important groups of aedine vectors of arboviruses. SAMP provides information on potential vectors for the guidance of military field research teams and other governmental agencies and prepares monographs and technical papers, which summarize data on the ecology, taxonomy and medical importance of these vectors in Africa. In addition, SAMP performs curation and research on the national collection of mosquitoes at the National Museum of Natural History (NMNH), Smithsonian Institution.

Research continues on the arbovirus vector groups of the subgenus Stegomyia, genus Aedes, of the Afrotropical Region.

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INTRODUCTION

Biosystematic studies, which lead to the precise identification of vectors, are fundamental to any investigation of epidemiology and to the planning of control or eradication.. These studies enable recognition of the vector(s); further study of the ecology and habits of the vectors; and effective diffusion of information about vectorial capacity, resistance to insecticides, geographic distribution, etc. Many instances of failure to control diseases resulting from vector-borne pathogens can be traced to neglect of this aspect of research in entomology.

The Systematics of Aedes Mosquito Project (SAMP) was developed to perform biosystematic research on medically important mosquitoes to meet the U.S. Army Medical Research and Development Command's requirements for accurate identification of actual or potential mosquito vectors of pathogens of man in Africa. Thus, SAMP is able to respond to these needs, and the resources of the project are used to accomplish these requirements. The research was accomplished by 1 professional entomologist plus the principal investigator. The work was supplemented by 4 professional entomologists from the Walter Reed Biosystematics Unit (WRBU) on assignment to the Smithsonian. In addition, upon request, SAMP assists various military and other medical entomologists in biosystematic studies of medically important mosquitoes. This level of support may range from furnishing entomologists with keys, necessary literature, and other identification guides to the loan of specialized collecting and rearing equipment, which cannot be obtained from other sources. Such support has proven invaluable to all concerned, as the Smithsonian Institution has received extremely worthwhile material from these entomologists.

REVIEW OF PROGRESS FOR THE PERIOD
August 1, 1985 - July 31, 1986 (Dr. Yiau-Min Huang)

1. Biosystematic studies of Aedes

A major portion of this grant period was devoted to two field-related projects: first, rearing larvae, pupae, and adults from mosquito eggs; and second, processing specimens that were collected during Dr. Huang's field trip to the Ivory Coast in the forepart of 1985. For the most part, the mosquito eggs came from the Ivory Coast, but Dr. L.G. Mukwaya also sent eggs from Uganda in April, 1986. Other tasks included dissecting genitalia, making slide preparations, identifying specimens, resolving taxonomic problems, preparing descriptions and illustrations, and writing manuscripts for publication.

During this period, two manuscripts were submitted for publication. The first paper concerns a study on the "Aedes furcifer-taylori group" of the subgenus Diceromyia Theobald. Although members of this species group are important as vectors of certain arboviruses, there remains much confusion in distinguishing between the species. This study responds to requests for identification assistance in support of ongoing U.S. Army Medical Research and Development Command research efforts in Africa.

Members of the "furcifer-taylori group" have been incriminated as vectors of yellow fever in Africa (Lewis, 1943, in the Nuba mountains, Sudan [as Anglo-Egyptian Sudan]; Cordellier et al., 1974, in Burkina Faso [as Upper Volta] and Mali; Port and Wilkes, 1979, in Gambia), and of Chikungunya (McIntosh et al., 1964, and Paterson and McIntosh, 1964, in Zimbabwe [as Southern Rhodesia]; McIntosh et al., 1977 and Jupp, 1980, in South Africa). The following viruses have also been isolated from members of the group: yellow fever, chikungunya, Zika, Bouboui and Bunyamwera in Senegal (Cornet et al., 1978, 1979) and yellow fever in Burkina Faso [as Upper Volta] (Baudon et al., 1984).

Aedes furcifer (Edwards) and Aedes taylori Edwards have been treated as two species that are difficult to separate morphologically. Furthermore, their distributions are usually sympatric. The difficulty in separating females of Ae. furcifer from Ae. taylori was first reported by Lewis (1943:72), who stated that "The distinguishing character of the females given by Edwards (1941) proves to be so variable in Sudan specimens of Ae. furcifer that the two species cannot always be differentiated... In the following observations these two very similar species are treated together." Since then, the so-called "Aedes furcifer-taylori group" has been used for these two species of mosquitoes, which have not always been differentiated by workers conducting studies on them (Haddow, 1961; McIntosh et al., 1964; Paterson and McIntosh, 1964; Cordellier et al., 1974; Cornet et al., 1978 and 1979; Port and Wilkes, 1979; Germain et al., 1980; Jupp, 1980).

Examination of available specimens at SAMP and other collections at the Smithsonian (USNM), has revealed that "taylori" is actually a complex of two species and that the species previously called taylori in East Africa (Kenya, Tanzania, Uganda) and in South Africa (Natal) is a different species. This study has been hampered by the lack of adequate specimens.

Recent field work in the Ivory Coast produced a reared series of a third species of the furcifer-taylori group, confirming earlier observations of an additional species from the limited material then available in our collections. Thus, the purpose of this paper is to describe the new species, with emphasis on characters to distinguish it from its sister species, Aedes taylori Edwards, and to provide other clarifying comments on the species group.

As a result of this study, a manuscript entitled "Notes on the Aedes (Diceromyia) furcifer group, with a description of a new species (Diptera: Culicidae)" was published in the Proceedings of the Entomological Society of Washington, 88(4):634-649 (1986).

The second paper, dealing with a new species of the Aedes africanus and entitled "Aedes (Stegomyia) corneti, a new species of the africanus subgroup (Diptera: Culicidae)" was likewise published in the Proceedings of the Entomological Society of Washington, 88(4):764-776 (1986).

The new species belonging to the Africanus Subgroup of the Aegypti Group was recently collected while conducting field work in Sierra Leone in 1984. This new species, which is extremely similar in overall habitus to adults of Aedes (Stegomyia) africanus (Theobald), was also found among specimens that were misidentified as Aedes africanus from the Services Scientifiques Centraux, Office de la Recherche Scientifique et Technique Outre-Mer (ORSTOM), the Institut Pasteur, Paris and the British Museum (Natural History) collections. Thus, the purpose of this paper is to describe the new species and provide diagnostic characters for separating the new species from Aedes africanus, thereby avoiding further confusion between it and Aedes africanus. Because of the medical importance of several species in the Africanus Subgroup and because nothing is known concerning the medical importance of the new species, it is hoped that this paper will stimulate investigations on that subject.

Work on the Ivory Coast Stegomyia specimens, which were recently obtained from my field work there, is underway. It is hoped that study of this material will resolve some of the taxonomic problems related to the africanus, luteocephalus, simpsoni and dendrophilus species complexes.

2. Curatorial Activities

During this period new material consisting of 452 adults of African Aedes were acquired from the following sources: (1) 21 lots of eggs of Aedes from the Ivory Coast trip were hatched and reared at SAMP. Individual rearings were carried out and adult specimens with their associated larval and pupal skins were prepared at SAMP for taxonomic studies. A total of 282 adults, 223 larval and 282 pupal skins, and 75 whole 4th instar larvae, belonging to subgenera (Stegomyia and Diceromyia) of the Genus Aedes, were obtained by this method; (2) 17 lots of eggs of Aedes (Stegomyia) africanus complex and Aedes (Stegomyia) simpsoni complex from Uganda (Dr. L. G. Mukwaya, Uganda Virus Research Institute, Uganda) were hatched at SAMP, from which 170 adults, 170 larval and 170 pupal skins, and 43 whole 4th instar larvae were obtained. In addition, a total of 116 male and female genitalia were prepared on slides during this period. To date, a total of 2,366 specimens (associated immature stages) were slide mounted.

3. Other Activities

(1) Identified 5 Aedes (Stegomyia) albopictus (Skuse) mosquitoes from U.S. (Houston, Texas and New Orleans, La.) for Dr. Daniel Sprenger, Harris County Mosquito Control District Houston; and Dr. Mike Andis, Mosquito Control District, New Orleans; and 193 Aedes (Stegomyia, Diceromyia, and Aedimorphus) mosquitoes from West Indies, Central African Republic, and Uganda for LTC. B.A. Harrison, Walter Reed Biosystematics Research Unit; Dr. B. Geoffroy, Services Scientifiques Centraux de l'O.R.S.T.O.M; and Dr. L.G. Mukwaya, Uganda Virus Research Institute; (2) Reviewed and wrote comments on 3 manuscripts for the Journal of Medical Entomology; Mosquito Systematics; and the Journal of the American Mosquito Control Association; (3) Assistance was given to Dr. Douglas Watts, U.S. Army Medical Research Institute of Infectious Diseases, Fort Detrick, Frederick, on information regarding yellow fever vectors in West Africa (including a list of some publications and 12 copies of the publications).

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Appendix 1: LIST OF SAMP CONSULTANTS

- Dr. Michael Cornet, Institut Pasteur de Dakar (ORSTOM), B.P. 220, Dakar, Republique de Senegal. African Aedes
- Dr. George B. Craig, Jr., Department of Biology, University of Notre Dame, Notre Dame, Indiana 46556. Genetics of Aedes
- Dr. Max Germain, ORSTOM, Head, 70-74 route d'Aulnay, 93140 Bondy, France. African Aedes
- CPT(P) Ralph E. Harbach, Ph.D., Department of Entomology, U.S. Army Medical Component, AFRIMS, APO, San Francisco, CA 96346. Culex of Southwest Asia
- LTC Bruce A. Harrison, Ph.D., Manager, Walter Reed Biosystematics Unit, MSC, Smithsonian Institution, Washington, D.C. 20560. Old World Anopheles and Southeast Asian mosquitoes
- CPT Kenneth J. Linthicum, Ph.D., Department of Arboviral Entomology, U.S. Army Medical Research Institute of Infectious Diseases, Fort Detrick, Frederick Maryland 21701-5000. African Aedes and Neotropical Anopheles
- Dr. Botha de Meillon, Philadelphia, PA. African Culicidae and Ceratopogonidae
- Dr. J. Mouchet, ORSTOM, Department of Entomology, Bondy, France. Culicidae
- Mr. E L. Peyton, Walter Reed Biosystematics Unit, MSC, Smithsonian Institution, Washington, D.C. 20560. Anopheles
- Dr. Lewis T. Nielsen, Biology Department, University of Utah, Salt Lake City, Utah 84112. North American Aedes (Ochlerotatus)
- COL John F. Feinert, Ph.D., Headquarters USAMRDC, SGRD-DPM, Ft. Detrick, Md 21701. Aedes subgenera
- CPT Daniel A. Strickman, Ph.D., Walter Reed Biosystematics Unit, MSC, Smithsonian Institution, Washington, D.C. 20560. Culex
- Dr. Ronald A. Ward, Department of Entomology, Walter Reed Institute of Research, Washington, D.C. 20012. New World mosquitoes

Dr. Richard C. Wilkerson, Walter Reed Biosystematics Unit, MSC, Smithsonian Institution, Washington, D.C. 20560. Neotropical Anopheles

Dr. Thomas J. Zavortink, Department of Biology, University of San Francisco, San Francisco, CA 94117. New World Culicidae, African Aedes (Neomelaniconion)

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